UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
RESEARCH TRIANGLE PARK, NC 27711

MEMORANDUM

SUBJECT: Approaches for the Development of a Low Volume Lead in Total Suspended Particulate (Pb-TSP) Sampler

FROM: Kevin Cavender, OAQPS/AQAD/AAMG

TO: Lead NAAQS Review Docket (OAR-2006-0735)

In the proposed revision to the Pb NAAQS the EPA proposed maintaining Pb-TSP as the indicator. The EPA also proposed network design requirements that could result in the need for an expansion and/or reallocation of Pb monitors. Due to the concerns over the existing high-volume Pb-TSP sampler, the EPA requested comments on the need for a Federal Reference Method (FRM) or Federal Equivalent Method (FEM) low-volume Pb-TSP sampler. The purpose of this memorandum is to identify and discuss approaches for the development of a low-volume Pb-TSP sampler for use in the Pb network. This memorandum will be used in a consultation with the Clean Air Scientific Advisory Committee (CASAC) Ambient Air Monitoring and Methods (AAMM) subcommittee on the need and approach for development of a low volume Pb-TSP sampler. This memorandum is intended to provide a discussion piece for use with the CASAC AAMM Subcommittee on the subject of low-volume lead in TSP and as such does not necessarily represent EPA policy that this type of sampler should be implemented.

OVERVIEW OF A POTENTIAL LOW-VOLUME Pb-TSP SAMPLER

A low-volume Pb-TSP sampler would consist of two parts – the inlet and the air sampler. The air sampler could be based on the low-volume air samplers used in the $PM_{2.5}$ and PM_{10} networks. However, a new inlet design would need to be specified.

A number of vendors offer what they refer to as a "low-volume TSP inlet".[1] In many cases, these low-volume TSP inlets are a low-volume PM_{10} inlet with the internal cyclone separator removed. An inlet of this design has many potential benefits - the PM_{10} FRM inlet is commercially available, PM_{10} FRM inlet designs are uniform, and the PM_{10} FRM inlet design is already promulgated.

As with all inlets, the PM_{10} FRM inlet sampler efficiency will vary with particulate size due to windspeed-dependent aspiration characteristics and internal particle losses through the sampler. Although the overall effectiveness of the PM_{10} FRM's inlet (including its internal PM_{10} fractionator) has been well-characterized (Tolocka et al., 2001), the aspiration characteristics of

[1] None of these samplers which use this inlet have currently been approved as a TSP FRM or FEM.

the inlet itself have not been determined. The omni-directional inlet design would eliminate variability in sampling efficiency due to wind direction. For larger particles, the sampling efficiency would still be affected by wind speed.

APPROACHES FOR DEVELOPMENT OF A LOW-VOLUME TSP SAMPLER

One approach for the development of a low-volume TSP sampler is to describe in detail and formally promulgate a new FRM for TSP sampling based on the modern low-volume sampler platform, and then designate all available commercial products that met the promulgated description as FRMs. Many of the FRM specifications from the PM_{10} FRM[2] could be referenced; however, geometric specifications for a TSP inlet design would need to be selected from designs currently available or newly developed.

The second approach for development of a low volume Pb-TSP sampler is to allow alternative inlet and sampler designs to be accepted as FEM Pb methods. Under this approach, collocated field testing of the low volume Pb-TSP sampler versus the current Pb-TSP FRM would be conducted according to the requirements of 40 CFR 53.33. If the two sampler's readings matched within some acceptable level, the EPA would accept the low volume Pb-TSP sampler as part of a FEM Pb method.

REFERENCES

Tolocka, M.P.; Peters, T.M.; Vanderpool, R.W.; Chen, Fu-Lin; and Wiener, R.W (2001) On the modification of the low flow-rate PM10 dichotomous sampler inlet. AS&T 34: 407-415.

[2] The Low-Volume PM_{10} (40 CFR Appendix O) and Low-Volume $PM_{2.5}$ FRM (40 CFR Appendix L) are very similar with the major difference being that the $PM_{2.5}$ FRM includes a second stage separator; either the WINS impactor or the Very Sharp Cut Cyclone (VSCC). The discussion in this paper refers to the low-volume PM_{10} sampler as it would most closely resemble a potential low-volume lead in TSP sampler since it already does not have a second stage separator, thus the major change would be elimination of the first stage PM_{10} separator.